

## CLAIMS

What is claimed is:

- 1           1.       A system that allows a table and a materialized view to be available  
2 while the materialized view is being refreshed, the system comprising:  
3           a materialized view that is derived at least in part from a table;  
4           a refresh log that contains a plurality of entries, each of the plurality of  
5               entries corresponding to a change in the table, each of the plurality  
6               of entries comprising an epoch identifier; and  
7           a refresh manager that performs a refresh operation on the materialized  
8               view in multiple steps by (a) successively reading a first subset of  
9               the plurality of entries indicated by a specific epoch identifier from  
10              the refresh log, (b) identifying a second subset of the plurality of  
11              entries from within the first subset of the plurality of entries, the  
12              second subset of the plurality of entries falling within a primary key  
13              value boundary and (c) applying the second subset of the plurality  
14              of entries to the materialized view.
  
- 1           2.       The system set forth in claim 1, wherein the corresponding epoch  
2 identifiers represent epoch numbers that have been created since a previous refresh  
3 operation on the materialized view.

1           3.       The system set forth in claim 1, wherein the second subset of the  
2   plurality of entries is applied to the materialized view in a primary key order.

1           4.       The system set forth in claim 1, wherein the refresh manager is  
2   adapted to distinguish between entries of the second subset of the plurality of  
3   entries that have already been applied to the materialized view in previous  
4   transactions and entries of the second subset of the plurality of entries that have not  
5   been applied to the materialized view in the event of a failure of the refresh  
6   operation.

1           5.       A method of refreshing a materialized view that is in part derived  
2   from a table, the method being adapted to improve the availability of the table and  
3   the materialized view while the materialized view is being refreshed, the method  
4   comprising:  
5       deriving a materialized view from at least one table;  
6       assigning an epoch identifier to changes made to the at least one table;  
7       storing an entry corresponding to each change to the at least one table in a  
8       refresh log that includes a plurality of entries, each of the plurality  
9       of entries comprising an epoch identifier; and  
10      performing a refresh operation in multiple operations, each of the multiple  
11      operations comprising (a) successively reading a first subset of the  
12      plurality of entries indicated by a specific epoch identifier from the

13 refresh log, (b) identifying a second subset of the plurality of entries  
14 from within the first subset of the plurality of entries, the second  
15 subset of the plurality of entries falling within a primary key value  
16 boundary and (c) applying the second subset of the plurality of  
17 entries to the materialized view..

1 6. The method set forth in claim 5, comprising applying the second  
2 subset of the plurality of entries to the materialized view in a primary key order.

1 7. The method set forth in claim 5, comprising defining the epoch  
2 identifier to correspond to changes that have been made to the table since a  
3 previous refresh operation on the materialized view.

1 8. The method set forth in claim 5, comprising distinguishing between  
2 entries of the second subset of the plurality of entries that have already been  
3 applied to the materialized view in previous transactions and entries of the second  
4 subset of the plurality of entries that have not been applied to the materialized view  
5 in the event of a failure of the refresh operation.

1           9.       A system that provides availability of a table and a materialized  
2 view while the materialized view is being refreshed, the table being derived at least  
3 in part from the materialized view, the system comprising:  
4           a refresh log that contains a plurality of entries; and  
5           a refresh manager that computes a table delta based on the refresh log and  
6           applies the table delta to the materialized view.

1           10.     The system set forth in claim 9, wherein each of the plurality of  
2 entries comprises an epoch identifier.

1           11.     The system set forth in claim 10, wherein the epoch identifier  
2 corresponds to changes that have been made to the table since a previous refresh  
3 operation on the materialized view.

1           12.     The system set forth in claim 9, wherein the table delta is applied to  
2 the materialized view in a primary key order.

1           13.     The system set forth in claim 9, wherein the table delta is used to  
2 refresh the materialized view in multiple transactions.

1           14.     The system set forth in claim 9, wherein a primary key value for  
2     each entry from the refresh log is recorded after that entry is applied to the  
3     materialized view.

1           15.     The system for refreshing the materialized view set forth in claim 9,  
2     wherein the refresh manager is adapted to distinguish between a first subset of the  
3     plurality of entries that have already been applied to the materialized view in  
4     previous transactions and a second subset of the plurality of entries that have not  
5     been applied to the materialized view in the event of a failure of the refresh  
6     operation.

1           16.     A method of refreshing a materialized view that is derived at least  
2     in part from a table, the method being adapted to provide availability of the table  
3     and the materialized view while the materialized view is being refreshed, the  
4     method comprising the acts of:  
5             storing a plurality of entries corresponding to changes in the table in a  
6             refresh log;  
7             computing a table delta based on the refresh log;  
8             refreshing the materialized view based on the table delta.

1           17.     The method set forth in claim 16, wherein the table delta is applied  
2     to the materialized view in a primary key order.

1           18.     The method set forth in claim 16, comprising updating the  
2     materialized view in multiple transactions.

1           19.     The method set forth in claim 16, comprising storing an epoch  
2     identifier as a portion of each of the plurality of entries.

1           20.     The method set forth in claim 19, comprising defining the epoch  
2     identifier to correspond to changes that have been made to the table since a  
3     previous refresh operation on the materialized view.

1           21.     The method set forth in claim 16, comprising recording the primary  
2     key value for each entry from the update log after that entry is applied to the  
3     materialized view.

1           22.     The method set forth in claim 16, comprising distinguishing  
2     between a first subset of the plurality of entries that have already been applied to  
3     the materialized view in previous transactions and a second subset of the plurality

4 of entries that have not been applied to the materialized view in the event of a  
5 failure of the act of refreshing the materialized view.

1           23.     A system that provides availability of a table and a materialized  
2 view while the materialized view is being refreshed, the table being derived at least  
3 in part from the materialized view, the system comprising:  
4           a refresh log that contains a plurality of entries; and  
5           means for computing a table delta based on the refresh log; and  
6           means for applying the contents of the table delta to the materialized view.

1           24.     The system set forth in claim 23, wherein each of the plurality of  
2 entries comprises an epoch identifier.

1           25.     The system set forth in claim 24, wherein the epoch identifier  
2 corresponds to changes that have been made to the table since a previous refresh  
3 operation on the materialized view.

1           26.     The system set forth in claim 23, wherein the means for applying  
2 the table delta to the materialized view is adapted to distinguish between a first  
3 subset of the plurality of entries that have already been applied to the materialized  
4 view in previous transactions and a second subset of the plurality of entries that

5 have not been applied to the materialized view in the event of a failure of applying  
6 the table delta to the materialized view.

1 27. A computer program, comprising:  
2 a machine readable medium;  
3 a refresh log stored on the machine readable medium, the refresh log  
4 containing a plurality of entries; and  
5 a refresh manager stored on the machine readable medium, the refresh  
6 manager being adapted to refresh a materialized view that is derived  
7 at least in part from a table by computing a table delta based on the  
8 refresh log and applying the table delta to the materialized view.

1 28. The computer program set forth in claim 27, wherein each of the  
2 plurality of entries comprises an epoch identifier.

1 29. The computer program set forth in claim 28, wherein the epoch  
2 identifier corresponds to changes that have been made to the table since a previous  
3 refresh operation on the materialized view.

1 30. The computer program set forth in claim 27, wherein the refresh  
2 manager is adapted to distinguish between a first subset of the plurality of entries



- 3 that have already been applied to the materialized view in previous transactions
- 4 and a second subset of the plurality of entries that have not been applied to the
- 5 materialized view in the event of a failure of a refresh operation.